

Customer No.: 31561
Docket No.: 10958-US-PA
Application No.: 10/604,651

REMARKS

Present Status of the Application

The Office Action rejected all presently-pending claims 1-28. Specifically, the Office Action rejected claims 1, 10, 20-28 under 35 U.S.C. 102(e), as being anticipated by Takayama (U.S. 6,610,142). The Office Action also rejected claims 1-28 under 35 U.S.C. 103(a) as being unpatentable over Takayama in view of Jen (JJAP Part 2: Letters 1991, 33(7B), L997-L979) and Luan (Jour. Of Appl. Phys. 1990, 68(7), 3445-3450).

Applicants have amended claims 1 and 10 and added claims 40 and 41 to more clearly define the present invention. After entry of the foregoing amendments, claims 1-28 and 40-41 remain pending in the present application, and reconsideration of those claims is respectfully requested.

Rejections of 35 U.S.C 102 (e)

Applicants respectfully traverse the rejection of claims 1, 10, 20-28 under 35 U.S.C. 102(e) because Takayama (U.S. 6,610,142) does not teach each and every element in the claims.

In order to properly anticipate Applicants' claimed invention under 35 U.S.C 102, each and every element of claim in issue must be found, "either expressly or inherently described, in a single prior art reference". "The identical invention must be shown in as complete details as is contained in the claim. Richardson v. Suzuki Motor Co., 868 F. 2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)." See M.P.E.P. 2131, 8th ed., 2001.

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The present invention is in general related to a method of forming a low temperature polysilicon thin film transistor as claims 1 and 10 recite:

Claim 1. A method of forming a low temperature polysilicon thin film transistor, comprising the steps of:

 forming an amorphous silicon layer over a substrate;
 performing a plasma treatment to the amorphous silicon layer, *wherein the plasma treatment comprises applying an oxygen-containing plasma or applying a hydrogen-containing plasma*;
 transforming the amorphous silicon layer into a polysilicon layer;
 patterning the polysilicon layer to form a plurality of island polysilicon layers;
 forming a channel region and a doped source/drain region on each side of the channel region in each island polysilicon layer; and
 forming a gate over each channel region.

Claim 10. A method of forming a low temperature polysilicon thin film transistor, comprising the steps of:

 providing a substrate;
 forming an amorphous silicon layer over the substrate;
 performing a plasma treatment to the amorphous silicon layer, *wherein the plasma treatment comprises applying an oxygen-containing plasma or applying a hydrogen-containing plasma*;
 performing a laser annealing process to transform the amorphous silicon layer into a polysilicon layer;
 patterning the polysilicon layer to form a plurality of island polysilicon layers;
 forming a gate insulation layer over the island polysilicon layers;
 forming a channel region in each island polysilicon layer and a doped source/drain region on each side to the channel regions; and
 forming a gate over the channel regions.

Tokayama fails to disclose, teach or suggest performing a plasma treatment to the amorphous silicon layer, wherein the plasma treatment comprises applying an oxygen-containing plasma or applying a hydrogen-containing plasma. In Tokayama's reference, the plasma treatment is performed to a silicon oxide layer before the amorphous silicon layer is formed in

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Examples 1-5. In Example 6, as shown in Fig. 9A, a uniform aqueous film 907 is formed over the substrate and a portion of the amorphous silicon layer 904 exposed by the silicon layer 905 is in contact with the aqueous film 907 having catalyst elements therein. Next, the amorphous silicon layer 904 is recrystallized by heating. The amorphous layer in all of the Examples of the citation is not treated by a plasma. Moreover, the citation discloses the nucleation sites are controlled by selectively exposing the amorphous silicon film to a plasma or by applying a substance containing elements having a catalytic effect thereto in the abstract. According to the description of the abstract, the plasma is used for controlling the nucleation sites in the amorphous layer. However, the citation fails to teach that the amorphous silicon layer is treated by an oxygen-containing plasma or a hydrogen-containing plasma.

Furthermore, claim 10 of Tokayama's reference also discloses "depositing said semiconductor film in contact with a catalyst metal which is capable of promoting crystallization thereof; and wherein said catalyst metal is provided by performing a plasma treatment in which said substrate is treated with a plasma produced by utilizing an electrode containing said catalyst metal." Apparently, the plasma treatment is used for providing said catalyst metal for promoting crystallization. However, the plasma of claims 1 and 10 of the present application is not used for promoting crystallization.

For at least the foregoing reasons, Applicant respectfully submits that independent claims 1 and 10 patently define over the prior art reference, and should be allowed. For at least the same reasons, dependent claims 20-28 patently define over the prior art as a matter of law, for at least the reason that these dependent claims contain all features of their respective independent claim.

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Rejections of 35 U.S.C 103 (a)

Applicants respectfully traverse the rejection of claims 1-28 under 103(a) as being unpatentable over Takayama (U.S. 6,610,142) in view of Jen (JJAP Part 2: Letters 1991, 33(7B), L997-L979) and Luan (Jour. Of Appl. Phys. 1990, 68(7), 3445-3450) because a prima facie case of obviousness has not been established by the Office Action.

To establish a prima facie case of obviousness under 35 U.S.C. 103(a), each of three requirements must be met. First, the reference or references, taken alone or combined, must teach or suggest each and every element in the claims. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skilled in the art, to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of the three requirements must "be found in the prior art, and not be based on applicant's disclosure." See M.P.E.P. 2143, 8th ed., February 2003.

As discussed above, Tokayama fails to disclose, teach or suggest performing a plasma treatment to the amorphous silicon layer, wherein the plasma treatment comprises applying an oxygen-containing plasma or applying a hydrogen-containing plasma. Lurn and Jen also fail to teach or suggest that the amorphous silicon layer is treated by a plasma treatment, wherein the plasma treatment comprises applying an oxygen-containing plasma or applying a hydrogen-containing plasma. In Lurn's reference, the NH₃ plasma treatment is performed to a gate nitride layer. In Jen's reference, the N₂O plasma is used to treat the deposited SiOxNy/SiNx gate insulators. Therefore, both Lurn and Jen fail to teach or suggest that the amorphous silicon layer

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is treated by a plasma treatment, wherein the plasma treatment comprises applying an oxygen-containing plasma or applying a hydrogen-containing plasma. The three references combined do not teach or suggest each and every element in claims 1 and 10.

While obviousness is ultimately a legal determination, it is based on several underlying issues of fact, namely: (1) the scope and content of the prior art; (2) the level of skill of a person of ordinary skill in the art; (3) the differences between the claimed invention and the teachings of the prior art; and (4) the extent of any objective indicia of non-obviousness. See Graham, 383 U.S. at 17-18.

When obviousness is based on the teachings of multiple prior art references, the movant must also establish some "suggestion, teaching, or motivation" that would have led a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed. See Tec Air, Inc. v. Denso Mfg. Mich. Inc., 192 F.3d 1353, 1359-60 (Fed. Cir. 1999); Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1572 (Fed. Cir. 1996).

The method disclosed by Tokayama is for enabling the crystallization of an amorphous silicon layer within a shorter period time. The NH₃ plasma treatment disclosed by Luan is performed to a gate nitride layer and can cause a general increase in subthreshold slope and threshold voltage of a TFT. The N₂O plasma disclosed by Jen is used to treat the deposited SiOxNy/SiNx gate insulators and can enable the TFT has a smaller threshold voltage. Therefore, the purpose of Tokayama is quite different from that of Luan and Jen. There is not any suggestion, teaching, or motivation that would have led a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed.

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For at least the foregoing reasons, a prima facie case of obviousness for claims 1 and 10 has not been established by the Office Action. For at least the same reasons, dependent claims 2-28 patently define over the prior art as a matter of law, for at least the reason that these dependent claims contain all features of their respective independent claim.

Newly added claims

Applicants further newly added claims 40-41. The limitation of claims 40-41 is not disclosed in the prior art references.

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CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Respectfully submitted,

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